

A NEW HOST OF LABOULBENIA FORMICARUM THAXTER, WITH REMARKS ON THE FUNGOUS PARASITES OF ANTS.

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Among some ants collected last summer near Boston, was found a worker of *Formica pallide-fulva* Latreille subsp. *schaufussi* Mayr, which on examination by Prof. Wheeler proved to be infested with the curious parasitic fungus *Laboulbenia formicarum* Thaxter. This ant was incidentally picked up, running over the sidewalk in Arborway Park, at Forest Hills, Mass. (August 7). I was unable to discover the infested nest or any other specimens carrying the fungus. In addition to the ant here mentioned, the known hosts of this fungus include now such common species as *Lasius niger* (Linné) var. *americanus* Emery, *L. niger* var. *neoniger* Emery, and *Formica subpolita* Mayr var. *neogagates* Emery. But, strange to say, it has been recorded thus far only from the vicinity of Boston, where it is of rather frequent occurrence (Cambridge, Ellisville and Forest Hills). There is apparently no reason why it should not be found in many other localities, when properly looked for.

The scarcity of parasitic fungi on ants is rather surprising and has often been commented upon. It is by no means due to lack of proper investigation; for ants exist everywhere in great abundance and have been intensely studied both in nature and in the cabinet; it would be difficult to name another group of insects of which such large numbers of specimens have been collected and examined. The great rarity of these fungous parasites can, however, be easily accounted for by the proverbial habits of cleanliness characteristic of ants, "which tend to suppress or render impossible the development of the fungi, except under unusual conditions. All ants devote a great deal of time and attention to cleaning their own integument and that of their nestmates. They are, indeed, forever combing and scraping the surfaces of their bodies with their tongues and strigils, so that fungi must find it difficult to gain a precarious foothold in their nests, to say nothing of an opportunity to proliferate" (Wheeler).

Laboulbenia formicarum belongs to the Laboulbeniaceæ, a family usually included among the sac fungi or Ascomycetes and exclusively found growing on living arthropods. Of the 600 or more described species of these fungi, the great majority attack beetles; only the three following have been hitherto recorded from ants. *Rickia Wasmannii* Cavara is the only ant-infesting form known from Europe, where it grows on *Myrmica lævinodis* Nylander and on *M. scabrinodis* Nylander. *Rickia formicicola* Spegazzini, recently described, was found on *Prenolepis silvestrii* Emery, in La Plata, Argentina. The hosts and distribution of *Laboulbenia formicarum* Thaxter have been mentioned above. These ant-inhabiting Laboulbeniaceæ are small and inconspicuous fungi, and when examined *in situ* on the host, appear like minute, usually dark-colored or yellowish bristles or bushy hairs, projecting from its chitinous integument either singly or in pairs, more commonly scattered, but often densely crowded over certain areas on which they form a furry coating; when infestation is excessive, the ants have been properly compared with hedgehogs, fairly bristling with tufts of the fungus (Wheeler). The detailed structure of these fungi can only be studied with a proper magnification, for the ant-attacking species are among the smallest members of the family, rarely exceeding one or two tenths of a millimeter in total length. Perhaps the most remarkable peculiarity of the Laboulbeniaceæ is their ability to thrive freely on their hosts without interfering much with its activity, inflicting little if any appreciable injury. In the case of the ant parasites, the parasitism is purely external, the fungus deriving its nourishment in all probability from the superficial layers of chitin or from deeper lying nutritive elements absorbed, without penetration, through the sucker-like foot.

Of the other fungous parasites of ants, certain Hypocreaceæ (Ascomycetes) of the genus *Cordyceps* are the most noteworthy, being of rather large size and of not unfrequent occurrence. In this case, the polycellular mycelium pervades the tissues of the host, which is rapidly killed, and often produces asexual spores or conidia borne on external hyphæ variously agglutinated or united (*Isaria* stage). The mycelium finally produces outside the body of the insect a boll-shaped or club-like organ or fructi-

fication, carried on a stalk sometimes several inches in length. The swollen portion of this external stroma bears numerous ascocarps or perithecia containing the spores, which are formed within elongate cells, the asci. Some hundred species of *Cordyceps* are known, all but two or three parasitic upon arthropods; as a rule they are but little particular in the choice of their host, the same species often attacking members of different species, families, or orders.

Ten species of *Cordyceps* have been recorded from ants, as can be seen from the appended bibliography; but most of these were found in the tropics. *Cordyceps unilateralis* (Tulasne), a rather widely distributed parasite of many insects, is the only form mentioned from ants in North America. Thaxter has recorded it incidentally as growing on an ant which was not further specified at the time, but, according to information kindly given to me by Prof. Wheeler, was a *Camponotus herculeanus* (Linné) subsp. *pennsylvanicus* (De Geer) from North Carolina.¹ It has been found on several other ants in South America and the East Indies. The external part of this *Cordyceps* consists of a black, very slender, thread-like stroma, 13 to 20 mm. long and $\frac{1}{4}$ to $\frac{1}{3}$ mm. thick at the base, feebly bent about or above the middle of its length where it bears on one side the perithecia fused into a subglobose head, 1 to 2 mm. in diameter, with rosette-like protuberances.

Cordyceps myrmecophila (Cesati) is a fungus of larger size and has been frequently observed on ants, though it attacks also various other insects. It is known from Europe (Italy, Finland), Brazil and tropical Africa. In the Belgian Congo its host of predilection apparently is the common large ponerine ant, *Paltothyreus tarsatus* (Fabricius). It is by no means rare to find dead specimens of this ant firmly attached with the closed mandibles to a leaf, a grass stalk or a stick, several inches or a few feet above the ground, while a long-stalked *Cordyceps* protrudes from the body. Though this position is often observed in ants that die

¹ Prof. Wheeler also informs me that unidentified *Cordyceps* are in Prof. Thaxter's collection from the following ants: *Camponotus herculeanus* subsp. *pennsylvanicus* var. *novaboracensis* (Fitch) from Maine and *C. abdominalis* (Fabricius) from Trinidad.

from fungous diseases, it is nevertheless remarkable in this case, since *Paltothyreus* is a foraging, strictly terrestrial ant, not known normally to climb the vegetation. The stroma of the fungus grows out of the side of the thorax, as a rule between one of the coxal articulations: a slender stalk, 2 cm. or more long, ends in a club-shaped fructification bearing the ascocarps. More rarely two such fructiferous stromata are borne by the same ant.

A number of so-called "imperfect fungi"—incompletely developed, conidia-bearing or sterile stages of various Ascomycetes—have been recorded from ants. A nest of *Formica rufa* Linné, at Potsdam, Germany, was heavily infested with fungous growths, about the size of a pin-head and attached mainly to the thorax, more rarely to other parts of the body. The ants were apparently but little hampered by their parasites. From cultures obtained with these fungi, Bischoff concluded that they belonged to several species, among them a *Mucor*, a *Penicillium* and a yeast. Thaxter also found in the vicinity of Cambridge, Mass., a fungus forming blackish incrustations on various parts of ants and giving rise to a few short, colorless, erect branches; the exact nature of this plant has not been determined, nor is the name of its host mentioned.

To complete this brief account of the fungous parasites of ants, I must still mention two imperfect fungi described by Prof. Thaxter. One of these, *Desmidiospora myrmecophila* Thaxter, of the family Mucedinaceæ, was growing luxuriantly on a large black ant fastened to the under side of a rotting log in Connecticut. The hyphæ, much branched and septate, covered the host in a white flocculent mass extending a short distance over the substratum. The host of this parasite has recently been identified by Prof. Wheeler as *Camponotus herculeanus* subsp. *pennsylvanicus* (De Geer). Prof. Wheeler further informs me that the same fungus is in Prof. Thaxter's collection from New Hampshire, growing on the same ant and its var. *novæboracensis* (Fitch). Another curious parasite belonging to the Dematiaceæ, *Hormiscium myrmecophilum* Thaxter, was found on various parts of a *Pseudomyrma* collected by W. M. Mann along the Amazon River, Brazil. The majority of the individuals taken from a nest were infected by the fungus, which is sufficiently

large to be readily visible as it projects from the surface of the host; it consists of brownish or nearly hyaline, closely septate filaments, about one quarter millimeter long, one to several arising from a deeply blackened foot.

AN ANNOTATED BIBLIOGRAPHY OF THE FUNGUS PARASITES
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